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IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF	:
TIZIANO TANAGLIA, ET AL.	: EXAMINER: NUTTER, N. M.
SERIAL NO: 10/507,218	:
FILED: SEPTEMBER 16, 2004	: GROUP ART UNIT: 1711
FOR: PROCESS FOR THE FUNCTIONALIZATION OF POLYOLEFINS	:

APPEAL BRIEF

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313-1450

SIR:

This is an appeal of the Final Rejection dated July 10, 2007 of Claims 1-17. A Notice of Appeal, along with a two-month extension of time, was timely filed on December 10, 2007.

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is Polimeri Europa S.p.A., having an address at Via e. Fermi 4, Brindisi, Italy I-72100.

II. RELATED APPEALS AND INTERFERENCES

Appellants, Appellants' legal representative and the assignee are aware of no appeals, interferences, or judicial proceedings which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF THE CLAIMS

Claims 1-17, all the claims in the application, stand rejected and are herein appealed.

IV. STATUS OF THE AMENDMENTS

No amendment under 37 CFR 1.116 has been filed.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

A summary of the claimed subject matter, as claimed in sole independent Claim 1, is mapped out below, with reference to page and line numbers in the specification added in **[bold]** after each element.

The claimed subject matter is drawn to a process for the functionalisation of polyolefins **[page 3, lines 11-13]** selected from the group consisting of:

- ethylene/propylene copolymers (EPM) with a molar propylene content ranging from 16% to 50%, and an Mw ranging from 10,000 to 200,000 **[page 3, lines 21-24]**; and
- ethylene/propylene/non-conjugated diolefin (EPDM) terpolymers **[page 3, lines 25 to page 4, line 1]** with a molar ethylene content ranging from 40 to

85% **[page 4, lines 5-6]**, from 15 to 70% of propylene **[page 4, lines 6-7]** and 2 to 10% molar of non-conjugated diene **[page 4, line 9]**, the molecular weights Mw of the EPDM being within the range from 75,000 to 450,000; **[page 4, lines 10-11]**

which comprises the treatment under shear conditions **[page 3, lines 12-14]** higher than 100 sec^{-1}, **[page 6, line 1]** with a polar unsaturated monomer **[page 3, line 14]** selected from the group consisting of maleic anhydride and its esters, amides, acid and metallic salt, **[page 5, lines 6-15]** in the presence of at least one hydroperoxide as radicalic initiator, **[page 3, lines 15-16]** the concentration of hydroperoxide with respect to the polyolefins ranging from 0.1 to 20% by weight. **[page 5, lines 18-19]**

VI. GROUNDS OF REJECTION

Ground (A)

Claims 1-12 and 15-17 stand rejected under 35 U.S.C. § 103(a) as unpatentable over US 2003/0013623 (Tse et al), taken in view of US 6,569,937 (Foulger et al).

Ground (B)

Claims 1, 3-9, 11, 12, and 15-17 stand rejected under 35 U.S.C. § 103(a) as unpatentable over US 6,383,439 (Schauder), taken in view of US 6,060,551 (Ooyama et al).

Ground (C)

Claims 1-17 stand provisionally rejected on the ground of nonstatutory obviousness-type double patenting over Claims 1-10 of copending Application No. 11/294,569 (US 2006/0135697) (Tanaglia '569).

Ground (D)

Claims 1-17 stand provisionally rejected on the ground of nonstatutory obviousness-type double patenting over Claims 1-13 of copending Application No. 11/100,522 (US 2005/0239666) (Tanaglia '522).

VII. ARGUMENT

Preface to Grounds (A) and (B)

As recited in Claim 1, an embodiment of the present invention is a process for the functionalisation of polyolefins selected from the group consisting of ethylene/propylene copolymers (EPM) with a molar propylene content ranging from 16% to 50%, and an Mw ranging from 10,000 to 200,000; and ethylene/propylene/non-conjugated diolefin (EPDM) terpolymers with a molar ethylene content ranging from 40 to 85%, from 15 to 70% of propylene and 2 to 10% molar of non-conjugated diene, the molecular weights Mw of the EPDM being within the range from 75,000 to 450,000; which comprises the treatment under shear conditions higher than 100 sec^{-1}, with a polar unsaturated monomer selected from the group consisting of maleic anhydride and its esters, amides, acid and metallic salt, in the presence of at least one hydroperoxide as radicalic initiator, the concentration of hydroperoxide with respect to the polyolefins ranging from 0.1 to 20% by weight.

As described in the specification beginning at page 2, line 1, reactions relating to functionalisation of polyolefins by grafting polar monomers using radicalic reactions promoted by peroxides are known, but use of peroxides is problematical. Peroxides favor crosslinking of polyolefins, in particular EPDM, in competition with the gradfting reaction, producing undesirable increases in molecular weight and broadening molecular weight distribution. Hydroperoxides have been considered as possible initiators for functionalisation of polyolefins. Under the conditions disclosed for such functionalisation in the prior art, i.e., low shear and a temperature higher than the decomposition temperature, the hydroperoxide behaves the same way as any radicalic initiator.

Applicants discovered that using a hydroperoxide radicalic initiator under shear conditions, the above-discussed grafting reactions can be carried out while effectively reducing the above-discussed crosslinking phenomena and uncontrolled increase in molecular weight, as well as elimination of formation of microgels and branchings.

The specification contains comparative data showing the significance of both (1) the use of a hydroperoxide, and (2) high shear conditions. Example 1 is according to the invention. Examples 2-4 are each comparative examples. (Comparative) Example 2 contains no initiator. (Comparative) Example 3 uses a peroxide instead of a hydroperoxide. (Comparative) Example 4 employs low shear conditions. The data in Table 1, at page 10 of the specification, shows successful grafting only for Example 1.

These results could not have been predicted by the applied prior art.

Ground (A)

Claims 1-12 and 15-17 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Tse et al, taken in view of Foulger et al. That rejection is untenable and should not be sustained.

Tse et al is drawn to an oil soluble viscosity index improver comprising a mixture of (A) at least one molecular weight degraded copolymer of ethylene and (B) at least one other alpha-olefin monomer; and at least one substantially undegraded copolymer of ethylene and at least one other alpha-olefin monomer (Abstract). Tse et al discloses a preferred degradation method using free radical initiators such as peroxides, where an acid or acid anhydride, such as maleic anhydride, can be present with the peroxide to promote decomposition of the peroxide in order to activate it; hydroperoxides are also disclosed [0118]. Indeed, one skilled in the art would not appreciate from Tse et al Applicants' discovery herein, as described in the specification and as exemplified by the comparative data therein, as discussed above. Rather than crosslinking of polyolefins, such as EPDM, which occurs with the use of peroxides as initiators, Applicants have discovered that a hydroperoxide, as required by the present claims, produces a different result. Compare Example 1 herein with (Comparative) Example 3, which uses a non-hydroperoxide, i.e., dicumyl peroxide as the initiator, and the data in Table 1 in the specification at page 10, lines 5-13. While Tse et al discloses the use of hydroperoxides, it is only disclosed as a substitute for the more preferred peroxides. Thus, Tse et al does not disclose functionalization of either of their copolymers of ethylene and at least one other alpha-olefin monomer, let alone with maleic anhydride or a derivative thereof as recited in Claim 1.

Foulger et al, relied on for a disclosure of shear rates, does not remedy any of the above-discussed deficiencies in Tse et al.

In the Final Rejection, the Examiner dismisses the above arguments, finding that Tse et al's disclosure of hydroperoxides as a substitute for peroxides, coupled with Foulger et al's disclosure of shear rates, is sufficient to defeat patentability.

In reply, in the process of degradation described by Tse et al, the maleic anhydride is disclosed as a promoter for decomposition of peroxide and therefore it would not be expected to react with the copolymer as a functionalising agent. Tse et al makes no distinction at all between peroxides and hydroperoxides, and, substantially, only the peroxides are exemplified. The presently-recited shear conditions are neither disclosed nor suggested by Tse et al. Thus, by using both a hydroperoxide and a high shear rate, one skilled in the art would have obtained a result not predicted and not even desired by Tse et al. This is the epitome of an unexpected result.

Claims 4-9

Claims 4-9, limited to EPDM terpolymers as the polyolefin to be functionalised, are separately patentable.

While Tse et al describes saturated copolymers of ethylene of the EPM kind, which copolymers may optionally contain other monomers such as non-conjugated dienes [0045-0046], which would be inclusive of unsaturated terpolymers of the EPDM kind, Tse et al makes no distinction between EPM and EPDM. None of the examples in Tse et al employ EPDM terpolymers; all employ EPM copolymers.

It is well-known that degradation, i.e., reduction of the average molecular weight, of saturated copolymers of the EPM kind may be obtained in the presence of peroxides, as said copolymers are saturated and branched, and commonly they tend, under conditions of high temperature and high shear, to break the polymeric chain through a radical route and to degrade, as correctly disclosed by Tse et al. Under such conditions, it would be very difficult for maleic anhydride or a derivative thereof to bind to the degraded EPM copolymer to functionalize it, due to the fact that the EPM copolymer does not contain olefinic unsaturated groups which may form such bonds.

In the case of EPDM, on the other hand, under analogous conditions, crosslinking takes place in the presence of peroxides, as discussed in the Preface above, as the EPDM terpolymers contain olefinic unsaturations along the polymeric chain. Tse et al does not appreciate the difference between saturated EPM type copolymers and unsaturated EPDM type terpolymers, as all the examples therein are drawn to EPM copolymers. See Table 4, footnote 1.

Thus, Tse et al neither discloses nor suggests functionalisation of unsaturated terpolymers of the EPDM kind, nor Applicants' surprising solution to the problem of increased molecular weight resulting from the use of peroxides (due to the crosslinking of the olefinic unsaturated groups) through the inventive combination of the use of hydroperoxides with a high shear, i.e., $>100\ sec^{-1}$.

For all the above reasons, it is respectfully requested that this rejection be REVERSED.

Ground (B)

Claims 1, 3-9, 11, 12, and 15-17 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Schauder, taken in view of Ooyama et al. That rejection is untenable and should not be sustained.

Schauder discloses EP(D)M elastomers graft modified with preferably maleic anhydride (column 4, lines 7-8), in the presence of an optional free radical initiator (column 3, line 34), wherein typical free radical agents are disclosed, such as various peroxides and azonitriles (column 3, lines 54-62). The Examiner finds that Schauder also discloses a hydroperoxide, although that is not evident from the particular listing of peroxides therein. Nevertheless, like Tse et al above, Schauder does not recognize the significance of the use of a hydroperoxide compared to a peroxide, for reasons discussed above. Nor does Schauder recognize the significance of the hydroperoxide as initiator even being present since, as discussed above, the initiator in Schauder is optional. (Comparative) Example 2 herein shows that the omission of an initiator significantly affects the final product. See Table 1 in the specification herein, *supra*. In other words, insignificant functionalisation occurs.

Ooyama et al, relied on for a disclosure of shear rates, does not remedy any of the above-discussed deficiencies of Schauder.

In the Final Rejection, the Examiner dismisses the above arguments, finding that Schauder discloses hydroperoxides and thus, failure to appreciate its significance compared to peroxides is, in essence, irrelevant.

In reply, Schauder does **not** disclose hydroperoxides. The Examiner incorrectly finds that t-butylcumylperoxide is an example of a hydroperoxide. It is not. Rather, it is a typical

dialkyl peroxide. Therefore, no structure of the ROOH kind is present. None of the peroxides disclosed in Schauder (column 3,lines 54-62) are hydroperoxides

For all the above reasons, it is respectfully requested that this rejection be REVERSED.

Ground (C)

Claims 1-17 stand provisionally rejected on the ground of nonstatutory obviousness-type double patenting over Claims 1-10 of Tanaglia '569. That rejection is untenable and should not be sustained. Applicants filed a terminal disclaimer over Tanaglia '569 with a Supplemental Response filed July 9, 2007. The provisional rejection is thus moot. Accordingly, it is respectfully requested that this rejection be REVERSED.

Ground (D)

Claims 1-17 stand provisionally rejected on the ground of nonstatutory obviousness-type double patenting over Claims 1-13 of Tanaglia '522. That rejection is untenable and should not be sustained. Applicants filed a terminal disclaimer over Tanaglia '522 with a Supplemental Response filed July 9, 2007. The provisional rejection is thus moot. Accordingly, it is respectfully requested that this rejection be REVERSED.

For all the above reasons, it is respectfully requested that this rejection be REVERSED.

VIII. CONCLUSION

For the above reasons, it is respectfully requested that all the rejections still pending in the Final Office Action be REVERSED.

Respectfully submitted,

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CLAIMS APPENDIX

Claim 1: A process for the functionalisation of polyolefins selected from the group consisting of:

- ethylene/propylene copolymers (EPM) with a molar propylene content ranging from 16% to 50%, and an Mw ranging from 10,000 to 200,000; and
- ethylene/propylene/non-conjugated diolefin (EPDM) terpolymers with a molar ethylene content ranging from 40 to 85%, from 15 to 70% of propylene and 2 to 10% molar of non-conjugated diene, the molecular weights Mw of the EPDM being within the range from 75,000 to 450,000;

which comprises the treatment under shear conditions higher than 100 sec^{-1}, with a polar unsaturated monomer selected from the group consisting of maleic anhydride and its esters, amides, acid and metallic salt, in the presence of at least one hydroperoxide as radicalic initiator, the concentration of hydroperoxide with respect to the polyolefins ranging from 0.1 to 20% by weight.

Claim 2: The process according to claim 1, wherein the shear conditions are higher than 1000 sec^{-1}.

Claim 3: The process according to claim 1, wherein the ethylene/propylene (EPM) copolymers are present and have a molar propylene content ranging from 20% to 45%.

Claim 4: The process according to claim 1, wherein the ethylene/propylene/non-conjugated diolefin (EPDM) terpolymers are present and have a molar ethylene content ranging from 40 to 70%, from 30 to 60% of propylene and from 0.5 to 20% of non-conjugated diene.

Claim 5: The process according to claim 4, wherein the ethylene/propylene/non-conjugated diolefin (EPDM) terpolymers have a molar content of non-conjugated diene ranging from 1 to 15% molar.

Claim 6: The process according to claim 5, wherein the ethylene/propylene/non-conjugated diolefin (EPDM) terpolymers have a molar content of non-conjugated diene ranging from 2 to 10% molar.

Claim 7: The process according to claim 4, wherein the ethylene/propylene/non-conjugated diolefin (EPDM) terpolymers have a molecular weight Mw ranging from 100,000 to 180,000.

Claim 8: The process according to claim 1, wherein the ethylene/propylene/non-conjugated diolefin (EPDM) terpolymers are present and the non-conjugated diolefins are selected from the group consisting of 1,4-hexadiene, 1,5-heptadiene, 1,6-octadiene, 1,4-cyclohexadiene, 5- methylene-2-norbornene, and 5-ethylidene-2-norbornene.

Claim 9: The process according to claim 8, wherein the non-conjugated diolefin is 5-ethylidene-2-norbornene.

Claim 10: The process according to claim 1, wherein the hydroperoxide is selected from the group consisting of cumene hydroperoxide, hydrogen peroxide, t-butyl hydroperoxide, and 2,5-dihydroperoxy-2,5-dimethyl hexane.

Claim 11: The process according to claim 1, wherein the concentration of hydroperoxide with respect to the polyolefins ranges from 0.2 to 10% by weight.

Claim 12: The process according to claim 11, wherein the concentration of hydroperoxide with respect to the polyolefins ranges from 0.5% to 5% by weight.

Claim 13: The process according to claim 1, wherein the quantity of polar unsaturated monomers ranges from 0.1 to 10% with respect to the polyolefins.

Claim 14: The process according to claim 13, wherein the quantity of polar unsaturated monomers ranges from 0.4 to 1.5% with respect to the polyolefins.

Claim 15: The process according to claim 1, carried out at a temperature ranging from 80 to 250°C, for a time ranging from 1 to 1800 seconds.

Claim 16: The process according to claim 15, wherein the temperature ranges from 140 to 200°C and the time ranges from 30 to 600 seconds.

Claim 17: The process according to claim 1, wherein the polar unsaturated monomer is maleic anhydride.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.